

Appln. No.: 09/942,835
Amendment Dated March 10, 2005
Reply to Office Action of December 10, 2005

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Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Currently Amended) A charge coupled device made according to a standard CMOS process on a substrate of a first conductivity type, the charge coupled device comprising:
 - a dielectric layer overlaying at least a portion of the substrate, the dielectric layer being a CMOS gate dielectric layer
 - at least two gate electrodes overlaying the dielectric layer, the at least two gate electrodes configured to define at least two charge wells; in the substrate of the first conductivity type, in response to a bias potential applied to the at least two gate electrodes, the at least two gate electrodes being separated by an inter-electrode gap in the substrate of the first conductivity type; and
 - apparatus for stabilizing the inter-electrode gap selected from a group consisting of:
 - a semiconductor region of the first conductivity type, formed in the inter-electrode gap, but having a different dopant concentration than the substrate, ~~in the inter-electrode gap~~; and
 - means for applying respective bias potentials to the at least two gate electrodes, the bias potentials being sufficient to cause a fringing field to extend across the inter-electrode gap from at least one of the at least two gate electrodes.
2. (Canceled)
3. (Previously Presented) A charge coupled device according to claim 1, wherein the apparatus for stabilizing the inter-electrode gap further includes:
 - a further dielectric layer formed over the at least two gate electrodes; and

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a further gate electrode formed overlying the further dielectric layer and selectively positioned over the inter-electrode gap.

4. - 6. (Canceled)

7. (Previously Presented) A charge coupled device made according to a standard CMOS process on a substrate of a first conductivity type, the charge coupled device comprising:

a dielectric layer overlaying at least a portion of the substrate, the dielectric layer being a CMOS gate dielectric layer;

at least two gate electrodes overlaying the dielectric layer, the at least two gate electrodes defining at least two charge wells, in the substrate, in response to a bias potential applied to the at least two gate electrodes, the at least two gate electrodes being separated by an inter-electrode gap; and

means for stabilizing the inter-electrode gap including means for applying respective bias potentials to the at least two gate electrodes, the bias potentials being sufficient to cause a fringing field to extend across the inter-electrode gap from at least one of the at least two gate electrodes to stabilize the inter-electrode gap by preventing charge barriers from interfering with charge transfer between adjacent gate electrodes.

8. (Original) A charge coupled device according to claim 1, wherein a first one of the charge well areas and its corresponding gate electrode form a photogate optical sensor and the charge coupled device further comprises:

a well region of a first conductivity type, adjacent to the photogate for forming a charge barrier well, the charge barrier well being configured to divert photocarriers into at least the photogate; and

a diffusion region of a second conductivity type, different from the first conductivity type, the diffusion region being formed inside the charge barrier well and being configured as an anti-blooming drain.

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9. (Original) A charge coupled device according to claim 8, further including:

a further well region of the first conductivity type, the further well region forming a further charge barrier well; and

a plurality of further diffusion regions of the second conductivity type in the further charge barrier well, the plurality of further diffusion regions forming a charge sink and a plurality of transistors, wherein one of the at least two gate electrodes that is not a photogate overlies a portion of the further charge barrier well adjacent to the charge sink.

10. (Original) A charge coupled device according to claim 9, wherein the plurality of transistors include a reset transistor and an emitter follower amplifier, both coupled to the charge sink.

11. (Currently Amended) An optical sensor circuit for receiving photocarriers from a source and being formed on a single monolithic substrate comprising:

a charge coupled device (CCD) array, the array being formed of a plurality of single polysilicon CMOS pixels, each pixel including,

a semiconductor layer of a first conductivity type formed on the substrate;

a first dielectric layer overlaying the semiconductor layer, the first dielectric layer being a CMOS gate dielectric layer;

at least two gate electrodes overlaying the first dielectric layer and configured to define at least two charge wells, respectively, in the semiconductor layer, in response to a bias potential applied to the at least two gate electrodes, wherein adjacent ones of the at least two gate electrodes are separated by an inter-electrode gap in the semiconductor layer, a combination of one of the at least two charge wells and its respective overlaying gate electrode forming a photogate optical sensor and a combination of another one of the at least two charge wells and its respective overlaying gate electrode forming a transfer gate; and

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apparatus for stabilizing the inter-electrode gap selected from a group consisting of:

a semiconductor region of the first conductivity type, formed in the inter-electrode gap, but having a different dopant concentration than the semiconductor layer, ~~in the inter-electrode gap~~; and

means for applying respective bias potentials to the at least two gate electrodes, the bias potentials being sufficient to cause a fringing field to extend across the inter-electrode gap from at least one of the at least two gate electrodes.

12. (Canceled)

13. (Original) An optical sensor according to claim 11, further comprising:

a well region of the first conductivity type, adjacent to the photogate for forming a charge barrier well, the charge barrier well being configured to divert photocarriers into at least the photogate; and

a diffusion region of a second conductivity type, different from the first conductivity type, the diffusion region being formed inside the charge barrier well and being configured as an anti-blooming drain.

14. (Original) An optical sensor according to claim 13, further including:

a further well region of the first conductivity type, the further well region forming a further charge barrier well; and

a plurality of further diffusion regions of the second conductivity type in the further charge barrier well, the plurality of further diffusion regions forming a charge sink and a plurality of transistors, wherein one of the at least two gate electrodes that is not a photogate overlies a portion of the further charge barrier well adjacent to the charge sink.

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15. (Original) A charge coupled device according to claim 13, wherein the plurality of transistors include a reset transistor and an emitter follower amplifier, both coupled to the charge sink.

16. (Original) An imager system comprising:

a single monolithic integrated circuit including:

a charge coupled device (CCD) imager array; and

a complementary metal oxide semiconductor (CMOS) analog to digital converter coupled to receive image signals from the CCD imager array.

17. (Original) A camera system comprising:

a single monolithic integrated circuit including:

a charge coupled device (CCD) imager array; and

a complementary metal oxide semiconductor (CMOS) analog to digital converter coupled to receive image signals from the CCD imager array; and

optics configured to focus radiation onto the CCD imager array.

18. (Currently Amended) A charge coupled device made according to a standard single polysilicon CMOS process, the charge coupled device comprising:

a substrate of a first conductivity type;

a well region of a second conductivity type, opposite to the first conductivity type;

an oxide layer formed over at least the well region, the oxide layer being a CMOS gate oxide layer;

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first and second polysilicon gate electrodes formed on the oxide layer over the well region, the first and second gate electrodes being separated by an inter-electrode gap in the well region, wherein the combination of the first and second polysilicon gate electrodes, the oxide layer and the well region form a buried channel CCD register; and

apparatus for stabilizing the inter-electrode gap selected from a group consisting of:

a semiconductor region of the second conductivity type, formed in the inter-electrode gap of the well region, but having a different dopant concentration than the well region, ~~in the inter-electrode gap~~; and

means for applying respective bias potentials to the at least two gate electrodes, the bias potentials being sufficient to cause a fringing field to extend across the inter-electrode gap from at least one of the at least two gate electrodes.

19. (Canceled)

20. (Original) A back illuminated imager comprising:

a substrate of a first conductivity type having a front side and a back side;

a photodetector formed in the front side of the substrate;

a well region of a second conductivity type, opposite to the first conductivity type, formed in the front side of the substrate and separate from the photodetector, the well region and the substrate forming a semiconductor junction; and

at least one diffusion region in the well region of the second conductivity type forming a component of the back illuminated imager;

whereby the component of the back illuminated imager is shielded from photocarriers generated in response to photons received at the back side of the substrate by the semiconductor junction.

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21. (Previously Presented) An electronic camera system comprising:

an imager formed according to one of claims 18 and 20; and

optics that are configured to focus radiation onto the imager.

22. - 30. (Canceled)

31. (Previously Presented) The charge coupled device of claim 11 ,
wherein the semiconductor layer is a transmission channel and the transmission channel is a
CMOS N-well.

32. (Previously Presented) The charge coupled device of claim 1, wherein
the at least two gate electrodes include at least two CMOS polysilicon gate electrodes.